UTD, Inc.

Innovative Directional and Position Specific Sampling Technique (POLO)

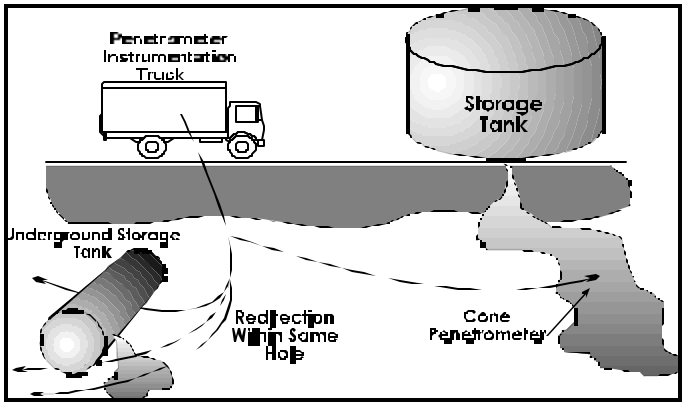
Technology Need:

Current sampling strategies to characterize soil and groundwater contamination are often limited by the cost of installing monitoring wells. The alignment of the well or the device inserted into the soil is conducted on an aim-and-shoot basis with only broad approximations of the actual locations of sampling points. True directional control or even accurate knowledge of the location of the point being sampled is not known, when in fact small errors in approximations of sampling location can have a significant impact on the interpretation of plume origins and other characteristics. A technology is needed that can accurately determine the subsurface location of a penetrometer rod.

Technology Description:

A unique real-time, in situ POsition LOcation (POLO) determination device which is smaller than other devices and not influenced by magnetic material has been developed. The Polo system offers, for the first time, the ability to map the position of characterization sensors in a borehole simultaneously with their insertion. Additionally, development of the position location tool opens the door to future developments which will allow for directionally controlled insertion of instruments. The basic concept of the POLO system is to define the trajectory of a borehole by navigating from point to point along its length to describe the shape and orientation of the centerline between each set of points.

Measurement is made by inserting an instrumented pipe section whose centerline corresponds to the centerline of the borehole. Strain gauge measurements on the walls of the test section provide trajectory information. The measurement module advances as the penetrometer rod is pushed into the borehole; it thus traverses the length of the borehole making measurements of the hole axis at successive measurement points.



Sample application of POLO

The POLO system is believed to be the only downhole position location tool which will meet the operational constraints of penetrometers and lysimeters as they are currently used and provide accurate downhole three-dimensional position determination. Further, the POLO system, used in conjunction with a steerable head, offers the opportunity to significantly extend the application of existing sampling techniques from their current mode of operation in vertical approximate location penetrations to both angled insertion and directional control of insertion to specific locations.

The POLO system has the potential to provide a reduction in public and occupational health risk as well as environmental risk by providing greater capability in characterization and monitoring through directional placement of sampling devices adjacent to steel or other magnetic material. Time of remediation will also be improved due to reduction in characterization time and monitoring device installation time, both of which affect remediation time.

Benefits:

<Immune to magnetic materials that are located beneath landfills, and building foundations

<More timely, more cost effective and safer site characterization

<Can safely operate near subsurface structures without causing any safety issues

<Accuracy of 0.50% of push distance

<Potential for future delivery of sampling devices

<Does not generate secondary waste and is easily decontaminated.

<Adds only 4% to cost of penetrometer use

Status and Accomplishments:

This project ended in September 1994. Development of the POLO System concluded with production and demonstration of a full-scale, integrated system. A preliminary field trial was conducted at the Fort Belvoir Army Base in Northern Virginia during June 1994. This was a prelude to performing a Full-scale Integrated System Demonstration at the Savannah River Site (SRS) in July 1994.

Results indicated that POLO is as accurate as any alternative approach at less than 0.50% error, and at a fraction of the cost. POLO can be used in close proximity to tanks, pipelines, and buildings with greatly reduced risk of puncture and resulting spills -- a major improvement over current approaches. POLO only adds about 4% to cost of penetrometer use.

Under the contract, one prototype POLO (POLO rod, data acquisition system, and initializer) plus a spare POLO downhole rod were manufactured. Based on lessons learned in this initial effort, a new UTD contract (DE-AR21-94MC31178) was awarded to include the integration of a commercial POLO with the SCAPS truck.

The POLO strain gaged rod and the tracking algorithm, which are the heart of the system has been patented. There is a commercial POLO system at SRS (POLO rod, downhole electronics, initializer, and computer).

UTD is actively marketing the product in addition to manufacturing a POLO-based tracking system for use inside of drill strings. This activity is being funded by a commercial drilling company. A field test in January 1998 for Ontario Hydro Technologies showed applicability for survey of drill strings. In addition, UTD has been marketing the POLO system to penetrometer contractors, selling the system as a bend indicator warning system, in addition to a path tracking device.

Contacts:

Ali Amini
UTD, Inc.
Phone: (703) 393-0800
E-mail: Info@UTDinc.com

Vijendra P. Kothari
National Energy Technology Laboratory
Phone: Phone: (304) 285-4579
E-mail: vijendra.kothari@netl.doe.gov

Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 316
http://ost.em.doe.gov/tms

The National Energy Technology Laboratory Internet address is http://www.netl.doe.gov

An Innovative Technology Summary Report (ITSR) for the POLO technology may be viewed at http://apps.em.doe.gov/ost/pubs/itsrs/itsr316.pdf

For additional information on this technology, please visit UTD's website at http://www.utdinc.com/